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EXAMINER

SANTIAGO, MARICEL I

ART UNIT

PAPER NUMBER

2879

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Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/746,114	<b>Applicant(s)</b> OKAMOTO ET AL.	
	<b>Examiner</b> Mariceli Santiago	<b>Art Unit</b> 2879	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-27 is/are pending in the application.
- 4a) Of the above claim(s) 15-27 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 10-12 is/are allowed.
- 6) ☒ Claim(s) 1-9, 13 and 14 is/are rejected.
- 7) ☒ Claim(s) 15-27 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
     If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) g.
- 4) ☐ Interview Summary (PTO-413) Paper No(s): \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Drawings***

Figures 7-10 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### ***Specification***

The abstract of the disclosure is objected to because it contains improper legal phraseology such as "said" and "disclosed is".

Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

Correction is required. See MPEP § 608.01(b).

### ***Claim Objections***

Claims 15-27 are objected to under 37 CFR 1.75(c) as being in improper form because a claim should not make reference to two sets of claims to different features. See MPEP § 608.01(n). Accordingly, the claims 15-27 are not been further treated on the merits.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2, 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 recites the limitation "said resultant ions" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 13 recites the limitation "said ions" in line 10. There is insufficient antecedent basis for this limitation in the claim.

Claim 14 recites the limitation "said ions" in line 10. There is insufficient antecedent basis for this limitation in the claim.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2 and 12 are rejected under 35 U.S.C. 102(b) as being anticipated by Colbert et al. (WO 98/05920).

Regarding claim 1, Colbert discloses a fabrication method of a nano-tube comprising the steps of radiating ions onto the nano-tube and oxidizing the nano-tube (Page 32, lines 5-26).

Regarding claim 2, Colbert discloses a fabrication method wherein in the ion radiating step after and element had been ionized, resultant ions are accelerated by an electric field and thereby radiated onto the nano-tube (Page 32, lines 5-26).

Regarding claim 12, Colbert discloses a fabrication method of a nano-tube wherein the nano-tube is a carbon nano-tube.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Colbert et al. (WO 98/05920) in view of Matsumoto (JP 07-57682).

Regarding claim 3, Colbert discloses the claimed invention except for the limitation of wherein an element has been reduced into plasma condition and the ions that have been produced in the plasma condition creating process are radiated onto the nano-tube. However, in the same field of endeavor, Matsumoto discloses an irradiation method involving ion generation by plasma. The Examiner notes that the selection of a particular ion irradiation technique, i.e. plasma generated or a high-speed ion beam, would be considered as an obvious matter of design choice since such techniques are art recognized equivalents in the field of ion irradiation. It would have been obvious to one of ordinary skills in the art at the time the invention was made to use the plasma generated ion irradiation technique instead of the irradiation technique disclosed by Colbert, since the selection of any of these known equivalents would be are considered within the level of ordinary skill in the art.

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Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakobson (US 6,280,677) in view of Rezeku (JP 07-172807).

Regarding claim 4, Yakobson discloses a fabrication method of a nano-tube comprising the steps of heating the nano-tube at a temperature of from 300° to 800°C, and radiating the nano-tube thus-heated (Column 3, lines 36-46) to create a physical change in the nano-tube structure. Yakobson fails to exemplify the radiation treatment being an ion radiation technique. However, the Examiner notes that the use of ion irradiation in order to modify the physical property of nano-tubes is considered well known in the art as evidenced by Rezeku. Rezeku discloses a method of irradiating a nano-tube with ions in order to provide a hole or aperture in the nano-tube and modify the physical structure of the nano-tube. It would have been obvious to one of ordinary skills in the art at the time the invention was made to use the ion irradiation disclosed by Rezeku instead of the X-ray or UV radiation disclosed by Yakobson, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art.

Regarding claim 5, Yakobson discloses a fabrication method of a nano-tube comprising the steps of heating the nano-tube at a temperature of from 300° to 800°C, and radiating the nano-tube thus-heated (Column 3, lines 36-46). Yakobson fails to exemplify the radiation treatment being an ion radiation technique. However, the Examiner notes that the use of ion irradiation in order to modify the physical property of nano-tubes is considered well known in the art as evidenced by Rezeku. Rezeku discloses a method of irradiating a nano-tube with ions in order to provide a hole or aperture in the nano-tube and modify the physical structure of the nano-tube. It would have been obvious to one of ordinary skills in the art at the time the invention was made to use the ion irradiation disclosed by Rezeku instead of the X-ray or UV radiation disclosed by Yakobson, since the selection of any of these known equivalents would be considered within the level of ordinary skill in the art.

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While the references are silent in regards to the limitation of heating and radiating the nano-tube simultaneously, the Examiner notes that the order in which the steps are performed, i.e. one after the other or simultaneously, is regarded as an obvious matter of design choice. It is well known that simultaneous execution of several steps during manufacturing procedures reduces the overall time of manufacturing, since what was being performed in two or more different steps is now performed in a single step. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to perform simultaneously the heating and radiating manufacturing steps disclosed by the references since such modification would be consider an obvious matter of design choice which would further reduce the overall manufacturing time of the product.

Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yakobson (US 6,280,677) in view of Colbert et al. (WO 98/05920).

Regarding claims 6 and 7, Colbert discloses a fabrication method of a nano-tube comprising the steps of placing the nano-tube on a glass substrate, and radiating ions onto the nano-tube thus heated (Page 32, lines 5-13). Colbert fails to disclose the step of heating the nano-tube at a temperature of from 300°C to a temperature lower than a distortion point of the glass substrate. However, Yakobson discloses a method of manufacturing a nano-tube comprising the step of heating the nano-tube at a temperature of from 300°C to 800°C in order to accelerate the treatment by radiation (Column 3, lines 36-46). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the heating step disclosed by Yakobson in the nano-tube fabrication method of Colbert in order to accelerate the treatment by radiation.

Regarding claims 8 and 9, Colbert discloses a fabrication method of a nano-tube comprising the steps of placing the nano-tube in a glass substrate, and radiating ions onto the

nano-tube thus-heated (Page 32, lines 5-13). Colbert fails to disclose the step of heating the nano-tube at a temperature of from 300°C to a temperature lower than a distortion point of the glass substrate. However, Yakobson discloses a method of manufacturing a nano-tube comprising the step of heating the nano-tube at a temperature of from 300°C to 800°C in order to accelerate the treatment by radiation (Column 3, lines 36-46). Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to incorporate the heating step disclosed by Yakobson in the nano-tube fabrication method of Colbert in order to accelerate the treatment by radiation.

Furthermore, while the references are silent in regards to the limitation of heating and radiating the nano-tube simultaneously, the Examiner notes that the order in which the steps are performed, i.e. one after the other or simultaneously, is regarded as an obvious matter of design choice. It is well known that simultaneous execution of several steps during manufacturing procedures reduces the overall time of manufacturing, since what was being performed in two or more different steps is now performed in a single step. Thus, it would have been obvious at the time the invention was made to a person having ordinary skills in the art to perform simultaneously the heating and radiating manufacturing steps disclosed by the references since such modification would be consider an obvious matter of design choice which would further reduce the overall manufacturing time of the product.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jin et al. (US 6,283,812) in view of Kaftanov (US 5,588,893).

Jin discloses a manufacturing method of a field emission type cold cathode, comprising an emitter containing therein nano-tubes, an insulating layer and gate electrode provided so as to surround the emitter, and an anode electrode provided on the gate electrode to thereby cause an emission of electrodes from the emitter by applying a voltage to the emitter (Fig. 11).



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Jin teaches that uniformity of protrusion is important in order to increase the number of emission sites in the emitter (Column 5, lines 4-21). Kaftanov discloses a method of manufacturing nano-tubes by a "burn-in" process after assembly of the field emission display device and causing field emission from the nano-tubes to modify the nano-tube structure as by rounding off the sharp points and further provide uniform protrusions. The "burn in" process is performed by use of residual gas in the field emission device to form ions as the inert or reactive gas species, which would irradiate the nano-tube (Column 3, lines 5-17). Thus the use of negative ions of oxygen or nitrogen or ions of other common atmospheric gases as the treating species, instead of electrons, would have been within the level of skills in the art. Accordingly, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to employ the "burn-in" process of Kaftanov to the field emitter of Jin since Jin acknowledges the preference of shorter nano-tubes and Kaftanov discloses that multiple field emission points can be modified to provide a uniform emission.

***Allowable Subject Matter***

Claims 10-11 are allowed over the prior art of record.

Claims 14 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action.

The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 10, the references of the Prior Art of record fails to teach or suggest the combination of the limitations as set forth in claim 10, and specifically comprising the steps of radiating ions onto the nano-tube, heating the nano-tube at a temperature of from 300°C to 800°C, radiating ions and an atomic state of atoms onto the nano-tube thus heated

Regarding claim 11, the references of the Prior Art of record fails to teach or suggest the combination of the limitations as set forth in claim 11, and specifically comprising the steps of radiating ions onto the nano-tube, heating the nano-tube at a temperature of from 300°C to 800°C, radiating ions and an atomic state of atoms onto the nano-tube thus heated, simultaneously.

Regarding claim 14, the references of the Prior Art of record fails to teach or suggest the combination of the limitations as set forth in claim 14, and specifically the steps of introducing a gas onto the emitter, applying a voltage to one of the gate electrode, the anode electrode, and a newly provided electrode to thereby cause an emission of the electrons, ionizing the gas, radiating ions onto the nano-tubes, and oxidizing the nano-tubes.

#### ***Other Prior Art Cited***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

#### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mariceli Santiago whose telephone number is (703) 305-1083. The examiner can normally be reached on Monday-Friday from 7:00 AM to 3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimesh Patel, can be reached on (703) 305-4794. The fax phone number for the organization where this application or proceeding is assigned is (703) 308-7382. Additionally, the following fax phone numbers can be used during the prosecution of this application (703) 872-9318 (for response before a Final Action) and (703) 872-9319 (for response after a Final Action).

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

*Wszg 6/13/03*  
Mariceli Santiago  
Patent Examiner  
Art Unit 2879

*Kenneth J. Ramsey*  
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